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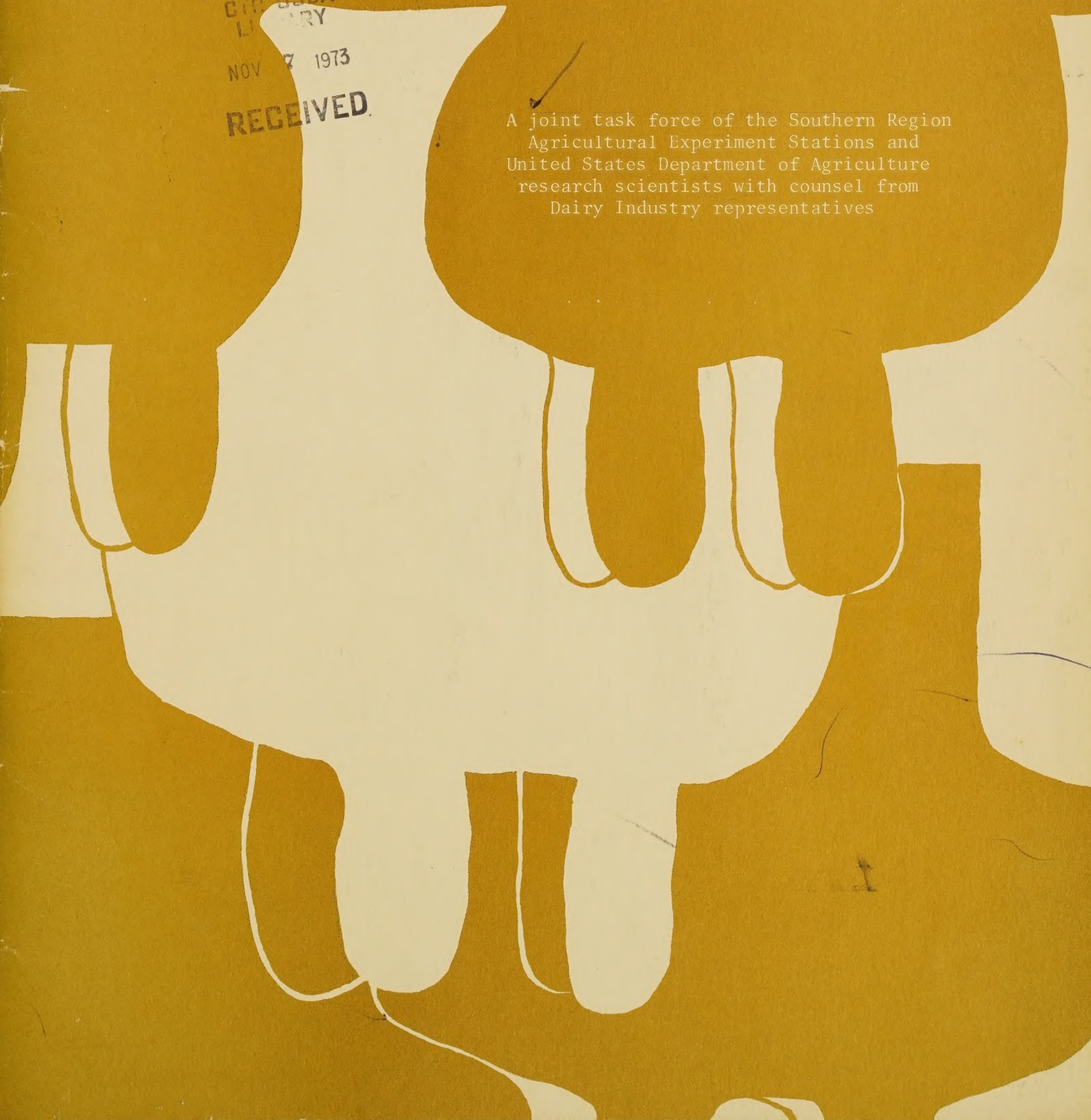
DAIRY RESEARCH NEEDS IN THE SOUTHERN REGION 1973

A joint task force of the Southern Region Agricultural Experiment Stations and United States Department of Agriculture research scientists with counsel from Dairy Industry representatives



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DAIRY RESEARCH NEEDS
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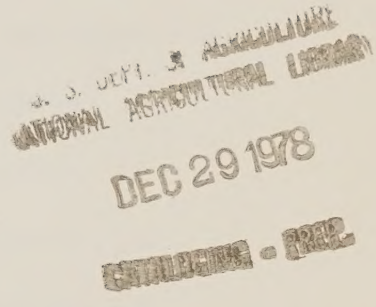

Prepared by:

A joint Task Force of the Southern Region
Agricultural Experiment Stations and
United States Department of Agriculture
research scientists with counsel from
Dairy Industry representatives

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SUMMARY TABLE OF RECOMMENDED SCIENTIFIC-MAN-YEARS AT CURRENT, NO INCREASE, AND RECOMMENDED LEVELS FOR DAIRY RESEARCH IN SOUTHERN REGION*

		SMY'S RECOMMENDED		
	RPA	SMY's Now	No Increase	10% Increase
A. Protection of Man and His Animals				
1. Insects and other arthropod pests	210	2.1	2.5	3.0
2. Diseases	211	5.9	5.5	6.5
	707	0.0	0.4	1.0
3. Parasites	212	5.8	2.2	2.2
4. Protection from hazards	213	2.4	1.5	1.5
	412	0.3	0.5	0.5
Subtotal		16.5	12.6	14.7
B. Efficient Production of Milk and Meat				
1. Reproduction	310	7.8	10.0	11.0
2. Nutrition	311	30.9	25.9	27.0
3. Genetics	311	8.2	7.0	7.0
4. Lactation	311	5.0	5.0	7.0
5. Environmental stress	312	1.5	2.7	2.7
6. Production management systems	313	3.2	5.6	7.0
7. Waste management	901	2.4	6.0	6.0
Subtotal		59.0	62.2	67.7
C. Dairy Product Development and Quality				
1. Production of milk for improved consumer acceptance	409	1.0	1.0	1.6
	410	8.1	8.1	8.1
	412	2.3	2.3	2.3
2. New and improved dairy processes and products	410	3.1	3.1	3.4
3. Systems of storage and handling	412	1.8	1.8	1.8
4. Grades and standards	501	0.4	0.4	0.4
5. Waste management	901	1.3	2.0	2.5
Subtotal		18.0	18.7	20.1
D. Efficiency of Marketing Milk and Dairy Products				
1. Dairy production economics	313	2.8	2.8	4.0
2. Marketing	503	3.0	3.0	3.4
	506	1.8	1.8	1.8
	507	0.4	0.4	0.4
	508	1.0	1.0	1.4
Subtotal		9.0	9.0	11.0
Unclassified		4.3	4.3	4.3
TOTAL		106.8	106.8	117.8

*The summary and recommendations for SMY's in this table pertain to Agricultural Experiment Station scientists only and do not include USDA scientists.

PREFACE

Background:

A Southern Regional Dairy Research Task Force was formed at the request of the Agricultural Experiment Station Directors of the Southern Region. Each of the directors of experiment stations in the Southern Region, as well as the administrators of the Cooperative State Research Service and the Agricultural Research Service, were asked to submit names of persons to serve on this task force. Members of the task force were selected on the basis of their expertise to evaluate nutrition, genetics, management, physiology, dairy technology, marketing and herd health research. The purpose of this task force is to begin developing coordinated and cooperative programs relative to state and federal research bodies in the Southern Region. The Task Force organized and met for the first time on August 24, 1972 and developed this report during the succeeding 12-month period. The Task Force decided that the target audience should be administrators who guide research through funding. Also the report should be available to individual researchers and dairy industry leaders.

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I. INTRODUCTION

The nation's dairy industry has been able to produce the milk and dairy product needs of the consumers of the United States and at the same time to improve the efficiency of this production with each advancing year. Since 1945 the total milk supply has been very steady, varying between 116 and 127 billion pounds annually. However, the current level of milk production in this country is being produced with less than half of the cows that were being used to produce this amount in 1945. Although the national milk production level has been fairly stable, milk produced in the Southern region has increased by over 50% in this same period.

People have consumed milk and dairy products at levels which, in 1971, made the following contributions toward their total needs of several very important nutrients:

Food energy	11.2%
Protein	22.2%
Fat	12.3%
Carbohydrates	7.0%
Calcium	76.1%
Phosphorus	36.1%
Iron	2.3%
Magnesium	22.1%
Vitamin A	11.2%
Thiamin	9.5%
Riboflavin	42.4%
Niacin	1.7%
Vitamin B_6	9.4%
Vitamin B_{12}	20.4%
Ascorbic acid	4.4%

Consumer demands for dairy products have been changing. Consumers have been demanding more low-fat products (although this trend may be lessening) such as skim milk and low-fat fluid milk (increased over 400% per capita from 1950 to 1971), cottage cheese (up 67% from 1950) and American cheese (up 30% from 1950). Butter consumption has declined by over 50% from 1950 and fresh whole milk has declined 20% during the same period. Looking at per capita utilization of the national milk supply, utilization of milk for all products has declined from 786 lbs. in 1945 to 513 lbs. in 1972. However, recent summaries have indicated that per capita consumption of non-fat milk nutrients have remained fairly steady over the last 20 years. Since 1945, our population growth has effectively offset lowered total per capita consumption. Also more efficient use of milk is taking place by increased recovery of non-fat nutrients that have formerly been discarded as waste by-products and from non-fat nutrients that were channeled into the feed industry or exported as non-fat dry milk powder. Further recovery of nutrients to meet greater needs may not be possible. This was exemplified, in 1972, with the industry-wide shortage of non-fat dry milk powder. Thus, we may be approaching the time when further shifts in the pricing structure of milk from the fat component to the non-fat nutrient components will be necessary. Also,

future research will likely be concentrated more on efficiency of production of protein and other non-fat milk nutrients than on total milk nutrients. This trend will be particularly important for the Southern region where both the population and milk consumption are increasing faster than the national average rate. The need will be most acute for greater production of milk for the fluid milk market. In 1972, there was a high demand in relation to supply and government stores of dairy products were nearly depleted. Some price shifting may take place but this marketing has been done with an efficiency that still has given consumers milk and milk products at rates requiring a smaller percent of their paychecks than at any time in history.

Situation:

Historically, most dairy farms were operated by owners and their families. However, in the past few years across the South the size of production unit has increased so that in most cases over half the labor input is full-time hired labor. High, fixed capital investments in buildings, equipment and dairy stock combined with regular daily milking, handling and delivery of a product to meet health and other standards set the dairy industry apart from all other farm enterprises. Dairy resources are not easily transferable. The dairyman generally operates at full capacity and markets the output continuously. Milk production requires a continuous and intensive application of labor.

Dairy production is decentralized. Milk is produced in important quantities in every state. And, in many Southern localities milk production is a major income base in the community. Because of its continuous flow and widespread production, the dairy industry contributes more to employment and local income than almost any other widespread farm enterprise. Therefore, research and agricultural policies which favor continuation of dairying on a widespread basis give economic stimulus to local business, are consistent with the preservation of the family farms, and are in the national interest. Although characteristically dairymen milked small herds for family use with sales to manufacturing milk plants in the past, by 1972 most milk production across the South was from commercial Grade A dairy herds. In most Southern states most milk for manufacturing uses comes from surplus Grade A milk. Thus, the Grade A or fluid milk industry in the Southern region is relatively new. A large proportion of dairymen are first generation dairymen who have been successful in expanding the dairy from small supplementary enterprises to large scale production units. Viable research and education programs are necessary to nurture this important industry within the region.

Milk is produced to meet the demands of consumers. Price influences this demand. The "real price" of milk to consumers has been declining. It is always the goal of agricultural research to increase further the efficiency of food production. Nutritional factors influence demands for foods too. However, this report is not addressed in a significant way to the major human nutritional factors that may relate to milk and dairy products. This report concentrates mainly on research of factors affecting the efficiency of milk production by the dairy cow, control of quality in products, fundamental research that may lead to improvements in efficiency of production and processing units, and marketing research.

Past research results have contributed greatly to the efficiency gains. Basically this program should continue but it is time to suggest modifications which will more nearly serve to advance the dairy industry over the next 10-year period.

Not enough of our research efforts have been coordinated to involve all of the subject matter disciplines important to the application of new practices. Recommendations made by workers from one discipline often tended to negate recommendations made by workers in other disciplines. Economic proofing of these recommendations was not carried out satisfactorily in most cases with this burden also being passed on to the dairyman. (More economic proofing of new practices can also have a very desirable effect of indicating in which areas and on which problems research money should be spent.)

Although there have been and continue to be vary fine research efforts being conducted on comparatively narrow problems, and a number of these need to continue, a new dimension in research needs to be encouraged. Encouragement of research efforts by combining discipline research teams and by individuals encompassing broader aspects of dairying holds hope of facilitating research progress and of developing coordinated recommendations.

In the research establishment, combined teams might include combinations of physiologists, nutritionists, biochemists, microbiologists, dairy technologists, geneticists, management specialists, disease specialists and economists among others. Teams should be formed to meet needs.

There are many reasons why very few combined teams have had high accomplishments. Among these are the methods by which funds are allocated and a general failure to administer these programs. However, a poor past performance should not deter efforts in finding ways to encourage and effectively administer combined teams when the obvious rewards are so great.

Although perhaps as much as 20% of dairy research should fall into the area of combined teams, this report is written in problem areas that need solutions. It is recommended that teams be used wherever feasible to give quicker, more complete solutions to these problems.

The format being followed in this report is similar to that used in the report, "A National Program of Research for Dairy," prepared by a joint task force of the U. S. Department of Agriculture and the State Universities and Land Grant Colleges, November, 1968. This breaks research goals and problem areas into four categories -- Protection, Production, Product Development and Quality and Marketing.

II. RESEARCH PROBLEMS AND GOALS

A. THE PROTECTION OF MAN AND HIS ANIMALS

Dairy herds are larger and more intensively managed and this situation has increased the stress on animals and the opportunity for transmission of disease. Also, the increased concern of the general public regarding air and water pollution, disease and toxicosis are forcing dairymen to be constantly alert to means of protecting the industry and maintaining a favorable image as a food producing establishment. Dairy farmers, in turn, have requested research to provide information necessary to protect animals and people who work in the industry as well as those who will consume milk and milk products.

In presenting research needs, emphasis has been placed on specific problems which are considered to be of the greatest importance to the dairy industry in the next 10 years. In this section, the projection for assignment of Scientific Man Years (SMY's) with no increase in SMY's in the Southern region, show need for some increase in research on insect control but indicate a decline in priority for research on parasite control and protection against hazards. The committee recommended a decline in SMY's in parasite work because it was felt that parasite problems are more nearly controllable with current technology and that industry research is contributing more to solving these problems than in many other problem areas. Insects and arthropods seem to be an expanding problem but only small increases were recommended due to the large amount of USDA research located in the Southern region. Even though the area "Protection from Hazards" is recognized as extremely important, a decrease in SMY's was recommended because it was felt that this area is being researched much more thoroughly by other governmental agencies, thus decreasing the need somewhat for Agricultural Experiment Station involvement.

1. CONTROL OF INSECT AND OTHER ARTHROPOD PESTS OF DAIRY CATTLE

		Recommendations if:	
	Now	No increase in Southern Region	10% increase in Southern Region
Scientific Man Years	2.1	2.5	3.0
Research Problem Area	210	210	210

Situation Evaluation:

Dairy cattle in the Southern states are attacked by a variety of flies, lice, ticks, gnats and other arthropods. Losses are represented by reduced milk production, weight losses, increased feed requirements, hide and flesh damage and diseases transmitted by insect vectors. Improved control measures that will reduce the exposure of animals to insects are urgently needed.

Objectives and/or Research Approaches:

a. Investigate the use of pesticides that are metabolized or eliminated by the animal so that residues do not accumulate in milk and meat.

b. Investigate the possibilities of biological control of insects by the use of natural enemies of these pests.

c. Determine the environmental and ecological requirements of the various pests and determine the feasibility of altering the same in cattle management systems.

d. Determine the fundamental basis of insect resistance to specific chemical groups and seek out genetic, physiological or chemical alternatives for circumventing resistance.

e. Investigate the effectiveness of the use of combinations of deterrents for insect control in modern management systems.

Potential Benefits:

The primary benefits to be gained from research in this area are reduced transmission of diseases and reduced chemical residue problems.

2. CONTROL OF DISEASES OF DAIRY CATTLE

		Recommendations if:	
	Now	No increase in Southern Region	10% increase in Southern Region
Scientific Man Years	5.9	5.9	7.5
Research Problem Areas	211(5.9)*	211(5.5)	211(6.5)
	707(0.0)	707(0.4)	707(1.0)

Distribution of SMY's by RPA No. is represented in ( ).

Of the many infectious disease complexes encountered in Southern dairy herds the following cause large economic loss:

Mastitis
Disease associated with animal reproduction
Enteric diseases
Respiratory diseases

Some of these diseases as well as others can be transmitted from animals to man and it therefore becomes important also to understand how to reduce or prevent this passage.

2a. MASTITIS

Situation Evaluation:

Mastitis is of major economic importance because of economic losses in the form of animals, milk production, and the adverse effect on milk quality. Unmarketable milk due to mastitis has been estimated at an average of 366 pounds per cow annually in the United States. Loss in reduction in longevity of cows is estimated at $84 million. Drug and veterinary services decrease annual income by some $67 million. The annual total loss due to mastitis has been estimated to be $500 million or 8% of the farm value of milk sold in the United States in 1970.

The emphasis on good sanitation, including dipping teats following milking, and treatment during the dry period has been effective and has resulted in significant reduction in losses from mastitis. Research needs to be intensified to evaluate the long-term consequences of these and other practices employed to reduce losses attributed to mastitis. Continued research in these areas is necessary because none of these practices is effective in controlling coliform infections. At the present time coliform infections are relatively infrequent but cause serious disturbances when they do occur. The incidence of coliform infections appears to be increasing. In addition, some organisms now susceptible to treatment are developing resistance to antibiotics in routine use. To date there has been little work on procedures for treating cows with mastitis under practical herd conditions. Research to develop objective, scientifically sound treatment procedures should be initiated. Some research effort should be directed toward developing a better understanding of the current field situation.

Objectives and/or Research Approaches:

a. Applied Management Oriented Research

   (1) Evaluate the relationship between specific management practices and sanitation procedures and incidence of mastitis.

   (2) Evaluate the effectiveness of certain products of preparations which may be useful in reducing the incidence of mastitis.

   (3) Determine the incidence of infection and related information in an evaluation of the situation for a given area.

b. Basic Research to Provide a Basis of New and Improved Control Procedures in the Future

   (1) Develop a comprehensive understanding of the animal's natural defense mechanisms against organisms that are the major causes of mastitis.

   (2) Develop a better understanding of the interaction between the environment and incidence of infection by specific pathogens.

(3) Develop a better understanding of the interaction between milking machine design and milking procedures and incidence of infection.

(4) Develop more effective means of eliminating infections from the mammary gland. This should include treatment of both milking and dry cows, and protection of milk supply following antibiotic treatment.

(5) Determine factors, including mastitis, that contribute to high somatic cell count, and/or other associated abnormalities, in milk.

Potential Benefits:

The development of an effective control program for mastitis can reduce the high economic loss encountered and reduce the adverse effects on milk quality. This will further enable dairy farmers to meet the requirements of the new abnormal-milk control program of the U. S. Public Health Service.

2b. REPRODUCTIVE DISEASES AND DISORDERS (See Section B-1)

Situation Evaluation:

Infertility and abortion in cattle continue to be a major problem, especially in occurrences for which no etiologic agent has yet been identified or controlled. Although the control and etiology of vibriosis, trichomoniosis, brucellosis and leptospirosis are well understood, the role of other organisms in reproductive failures is obscure. Repeat breedings and early embryonic deaths may be partially caused by involvement of infectious agents of unknown etiology. In addition, the known viral infections of IBR and BVD-MD which cause abortion need further study to improve diagnostic and control procedures.

Objectives and/or Research Approaches:

a. Identify the causes and characterize the reproductive failures of unknown etiology.

b. Develop and improve diagnostic procedures associated with reproductive failures.

c. Develop improved methods of treating reproductive disorders such as retained placentas, silent estrus, anestrus conditions and cystic ovaries.

d. Develop information on prognosis for recovery from reproductive disorders and the economic implications of prognosis.

Potential Benefits:

Increased reproductive efficiency, increased productive life of high producing cows and decreased financial losses due to irregular breeding.

2c. CALF ENTERIC DISEASES

Situation Evaluation:

An increasing incidence of the enteritis complex and resulting death losses exists throughout the Southern and other regions of the United States.

Losses from enteric diseases of neonatal calves in herds frequently amount to 10 and range upward to 50 percent of the annual calf crop. In addition to losses by death, many survivors are permanently affected and remain unthrifty into adulthood resulting in additional financial losses. Two general areas of disease contribute to calf losses: (a) diseases of the dam that prevent development of a healthy fetus and the birth of a viable calf, and (b) diseases that develop in young calves between birth and 3 months of age. Infectious diseases causing significant mortality in young calves are the enteritis complex, commonly referred to as calf scours; the enterotoxemia group; pneumonia; calf diphtheria (necrotic stomatitis and laryngitis); umbilical infection; and leptospirosis. Methods of control are currently available for some of these diseases. Examples are antitoxins and toxoids for clostridial enterotoxemia and vaccines for calf diphtheria and leptospirosis. Prompt diagnosis and the use of biological agents and antibacterial agents prevent high mortality in these and other conditions. However, the same cannot be said for the enteritis complex in young calves. Although much progress has been made in the elucidation of the calf scour problem related to predisposing factors and treatment of individual cases, there exists an increasing incidence of the disease and resulting death losses in dairy calves throughout the Southern region as well as other regions of the United States. An additional concern is there has been an increase in the incidence in antibiotic residues in veal calves at slaughter.

Objectives and/or Research Approaches:

a. Study the susceptibility of neonatal calves to the calf scour complex and its relationship to the serum immunoglobulin levels in cow and offspring.

b. Determine the relationship of bacterial and viral agents in pathogenesis of the calfhood disease.

c. Determine the etiology of calf diarrhea in field outbreaks and under controlled conditions.

d. Investigate therapeutic agents for calf scours.

Intensify research on:

a. Studies to elucidate the most efficient methods of rearing neonatal dairy calves. This should include environmental factors that predispose the calf to disease and economical methods to control these factors.

b. Investigations of methods to increase the resistance of the neonatal calf to disease.

Potential Benefits:

Reduced death loss of valuable animals and more vigorous growth of young cattle.

2d. RESPIRATORY DISEASES

Situation Evaluation:

Respiratory disease, often associated with enteric disease in young dairy calves, continues to be a cause of extensive death loss and retarded development. Much research has been done in this field in order to determine etiology and the relationship of respiratory pathogens to the agent producing enteritis. Several adenoviruses may be important. Respiratory diseases are a major problem as the cause of both primary and secondary infections of calves. In addition, the incidence, diagnostic procedures and treatment of viral infections such as IBR and PI-3 in adult cows needs further study to provide effective control of respiratory infections.

Objectives and/or Research Approaches:

a. Characterize the etiology of viral agents involved in respiratory diseases.

b. Evaluate the effectiveness of vaccination procedures for viral agents involved in respiratory disorders.

Potential Benefits:

Effective control of respiratory diseases will result in healthier animals and reduced rearing costs of replacement heifers, dairy beef and breeding bulls.

2e. PREVENT TRANSMISSION OF CATTLE DISEASES AND PARASITES TO PEOPLE

Situation Evaluation:

Although much progress has been made in eradicating brucellosis and tuberculosis there remain many diseases that are a potential threat to human health. These include leptospirosis, chlomydiosis, Q-fever, listeriosis, anthrax, salmonellosis, vibriosis, vesicular stomatitis, ringworn, cutaneous streptothricosis and several parasitic diseases. The primary danger is on the farm where people are in close contact with infected animals.

Objectives and/or Research Approaches:

a. Cooperative research with other disciplines in attempting to elucidate sources of infection in animals and the mechanisms involved in the transmission of animal diseases to people.

b. Secure information on the incidence in man of the various diseases thought to be transmitted from cattle.

c. Study the role of insect vectors and other sources of transmission of disease from cattle to man.

Potential Benefits:

The danger of disease in people working with cattle will be reduced by controlling or eliminating diseases of cattle transmissible to man.

3. CONTROL OF PARASITES OF DAIRY CATTLE

		Recommendations if:	
	Now	No increase in Southern Region	10% increase in Southern Region
Scientific Man Years	5.8	2.2	2.2
Research Problem Area	212	212	212

Situation Evaluation:

Internal parasites, including gastrointestinal parasites, lungworms, anaplasma and coccidia, continue to cause economic loss to dairymen. Losses occur as mortality, reduced growth and development, poor conversion of feed nutrients, lowered resistance to disease, poor breeding and conception rates and lowered carcass value of dairy beef. The parasites affecting dairy cattle also pose a serious problem for the beef industry. In extensive surveys by a private company covering 140 dairy herds in 9 states, the actual number of individual animals parasitized averaged 67% of those tested. In a Wisconsin study, milking cows treated for worm parasites averaged 2.6 pounds of milk per day more than untreated controls. The study included 500 treated cows and 200 control cows on 8 farms.

A small research program should be maintained in several locations throughout the region to evaluate the influence of changing management on the incidence of parasite infection, and the relation between treatment and incidence and economic losses.

It is well known that anaplasmosis is confined largely to the Southern states, particularly in the Gulf Coast and Delta regions. While a recently developed vaccine offers much encouragement as a means of controlling anaplasmosis, this vaccine causes intravascular hemolysis in calves in certain situations. More research is needed to perfect this vaccine.

Objectives and/or Research Approaches:

a. Applied Research for Dairy

(1) Study the biology and incidence of various internal parasites under present and developing systems of dairy management.

(2) Evaluate the effectiveness of various treatment regimes in reducing economic losses.

(3) Evaluate the consequences of treatments to prevent or eliminate parasites in terms of residues which may appear in the meat and/or milk.

b. Basic and Applied Research also Applicable to Beef Cattle and Other Ruminants

(1) Develop a better understanding of the biological characteristics of causative nature of the various parasites.

(2) Develop better methods of protecting animals from anaplasmosis and coccidiosis to include improvement of anaplasmosis vaccine and possible immunization against coccidiosis.

(3) The use of larvacides to control parasitism.

(4) Develop better methods for treating affected animals and for destroying the parasites in the environmental stage of their life cycles.

(5) Control of insect vectors and improvement of methods for destroying the carrier state in anaplasmosis.

Potential Benefits:

Economic losses due to parasitism can be reduced and healthy, more vigorous animals for productive purposes can be raised.

4. PROTECTION FROM HAZARDS

		Recommendations if:	
	Now	No increase in Southern Region	10% increase in Southern Region
Scientific Man Years	2.7	2.0	2.0
Research Problem Areas	213(2.4)*	213(1.5)	213(1.5)
	412(0.3)	412(0.5)	412(0.5)

*Distribution of SMY's by RPA No. is represented in ( ).

Situation Evaluation:

Dairy cattle are exposed to environmental hazards such as mycotoxins, poisonous plants, residues from agricultural chemicals and other pollutants. Recommendations from agricultural institutions should be based on research to insure that animal products will not contain chemicals unapproved by health authorities. Accidental contamination from all sources should be reduced to a minimum to insure that high quality standards are maintained for milk and milk products. Occasional publication of milk contamination from any source decreases the demand for milk and milk products.

Objectives and/or Research Approaches:

a. Secure information on breakdown metabolites, storage sites in the animal, excretion and secretion patterns of major pesticides and herbicides as they are developed and before being released.

b. Study methods for rapid decontamination of animals accidentally contaminated by agricultural chemicals.

c. Determine the maximum levels of these chemicals which may be in tissues of the animal without deleterious effects on the animal itself or the developing fetus.

d. Determine the maximum levels of chemical or their degradation products which may be in milk without deleterious effects on the calf.

e. Study the occurrence of polychlorinated biphenyls (PCB's) in milk and in silage and other livestock feeds. The toxicology of various PCB's, their interaction with feed nutrients, and the metabolic pathways and storage location of PCB's in the dairy cow should be investigated.

f. Cooperative research with other disciplines in screening animals and milk for residues of mycotoxins, poisonous plants, toxic minerals from drinking water and other hazards.

Potential Benefits:

Research in this area would result in protection of milk and meat for human consumption.

B. EFFICIENT PRODUCTION OF MILK AND MEAT FROM DAIRY CATTLE

The basic unit of the dairy industry is the milk cow. She is used on dairy farms to transform feed materials, largely forages and waste products not directly useful for human food, into a nutritious and valuable human food. In terms of the gross edible food product output as a percentage of food intake the milk cow is twice as efficient for milk production as broilers, the second most efficient converter; three times as efficient as swine, turkeys and egglaying hens; and nine times as efficient as she and other cattle are in the production of beef. And, gross efficiency is destined to continue to improve as long as continued advances are made in production per cow. Cost efficiency advances will depend on reaching solutions or making improvements in the areas that are most limiting advancement.

In this section SMY recommendations with no increase in SMY's in the Southern region are for major increases in the areas of waste management, reproduction and production management systems. An increase was also recommended for research in the environmental stress area. Although nutrition is recognized as being an extremely important area as indicated by the fact that more SMY's are still recommended for this problem area than any other single problem area in this report, a sizable portion of the SMY's recommended for increasing in other areas must be obtained from this problem area. Dairy Cattle Genetics was projected for a decrease as well.

1. REPRODUCTION

		Recommendations if:	
	Now	No increase in Southern Region	10% increase in Southern Region
Scientific Man Years	7.8	10.0	11.0
Research Problem Area	310	310	310

Situation Evaluation:

Reproduction difficulties continue to be the source of large economic losses to dairymen. Reproduction initiates lactation. Poor reproduction therefore curtails production. Several areas will require intensive research efforts. Embryonic deaths were shown to be sizable in work done 25 years ago. Little progress has been made to reduce these losses in the intervening time. All available techniques, including the analysis of uterine secretions and embryo culture, need to be used to determine the causes. Continued work is needed to assess freezing and thawing characteristics of sperm as semen storage containers change (ampule vs. French Straw). Additional work is needed to develop good semen stored under farm tank conditions as well as semen shipped from semen producing bull studs. Nutritional, genetic and stress conditions need to be related to reproductive efficiency.

Objectives and/or Research Approaches:

a. Uterine fluids taken at various stages of the reproductive cycle should be subjected to physical biochemical techniques to determine the amount and types of proteins present as well as the inorganic ions present and mineral binding capacities.

b. Embryos should be subjected to in vitro culturing techniques to gain insight concerning the cause(s) of embryonic losses, i.e. genetic or uterine environment deficiency.

c. Work needs to be done in which freezing and thawing rates of semen samples are carefully controlled and the correlated livability and fertilizing capacity are correlated with freeze-thaw rates.

d. Morphological deterioration at the microscopic level needs to be better related as a predictor of fertility. The interference contrast microscope as it is used to detect acrosome deterioration is a good example of possible simple tests for measuring semen quality.

e. Broad studies need to be undertaken to relate nutritional genetic and stress conditions including production to reproductive efficiency and to further relate the nature of the mechanisms causing reproductive inefficiency in each case.

Potential Benefits:

Even small improvements in reproductive efficiency could result in large economic savings for dairymen and in the cost of producing milk.

2. NUTRITION

		Recommendations if:	
	Now	No increase Southern Region	10% increase in Southern Region
Scientific Man Years	30.9	25.9	27.0
Research Problem Area	311	311	311

Situation Evaluation:

Much progress has been made toward the most efficient use of nutrients by dairy cows under varying conditions of lactation, pregnancy, environmental temperature, social pressures and physical aspect of dietary ingredients. Much more remains to be done. Further efforts are needed to optimize protein and energy intake so that the animal's requirements are met for maximum growth and production without overfeeding and achieving a lowered digestibility. A number of problems relating to optimum mineral availability for growth and high production also persist. Interactions of minerals with each other as well as with other feed ingredients are not well understood.

Objectives and/or Research Approaches:

a. Evaluate the requirements of energy and protein for maximum growth or production. Data of this type need to be placed into ration formulation equations so that a closer fit of dairy cow needs and what is actually fed is achieved.

b. Evaluate the availability of essential minerals under a wide range of diets (other ingredients).

c. Evaluate the possibilities of amino acid supplementation for improvement of production in high producing cows.

d. Develop a more complete understanding of the metabolism of nutrients so that methods of improving metabolic efficiency may be more logically hypothesized.

Potential Benefits:

Considerable improvement is still possible in biological efficiency through nutrition. As production levels become higher additional possibilities for new gains also become possible.

3. DAIRY CATTLE GENETICS

		Recommendations if:	
	Now	No increase Southern Region	10% increase in Southern Region
Scientific Man Years	8.2	7.0	7.0
Research Problem Area	311	311	311

Situation Evaluation:

The major thrust in dairy cattle breeding should be aimed at maximizing genetic progress in economically important traits. Milk production is at present the most economically important trait and should receive major emphasis. The importance of other traits relative to milk production are not as well defined economically. Selection is the most important tool available to achieve genetic progress in dairy cattle breeding. Short term responses to selection have been predicted with a high degree of accuracy but the degree of long term response is not as well documented. The relative emphasis which should be placed on other traits is uncertain. Management systems under which long term selection studies are carried out should relate to those conditions that exist or will exist in the future in commercial dairy operations. The degree of response from selection for milk production may not be affected by the management system; however, the degree of importance of other traits may be directly influenced by management systems. Genetic studies have the potential for being the core for a team approach to interdisciplinary research. Nutritional studies, reproductive performance, herd health, and management studies could and should be coordinated into long term breeding projects.

Objectives and/or Research Approaches:

a. Increasing the accuracy and effectiveness of pedigree selection and decreasing generation interval.

b. Refinement of methods of selecting and evaluating sires based on progeny information.

c. Obtaining economic assessments of various traits and evaluating changes in these traits resulting from direct selection for milk yield.

Potential Benefits:

Genetic gains in animal traits contributing to increased efficiency are essential for continued increases in efficiency of production.

4. LACTATION

	Now	Recommendations if: No increase in Southern Region	Recommendations if: 10% increase in Southern Region
Scientific Man Years	5.0	5.0	7.0
Research Problem Areas	311	311	311

Situation Evaluation:

The physiology of lactation and the induction of lactation are understood in a general sense but the more detailed aspects are not well understood. This lack of understanding can result in actual lactations which fall far short of the biological potential. The experimental induction of lactation gives the possibility of extending the useful life of high producing cows which fail to conceive.

Objectives and/or Research Approaches:

a. Investigate the levels and sequences of hormone elaboration in relation to normal lactations.

b. Investigate the hormones, hormonal sequences, and amounts of hormones needed to experimentally induce lactation.

Potential Benefits:

Lactations which result in more milk or the salvaging of cows which fail to conceive can be of great economic value.

5. ENVIRONMENTAL STRESS

	Now	Recommendations if: No increase in Southern Region	Recommendations if: 10% increase in Southern Region
Scientific Man Years	1.5	2.7	2.7
Research Problem Area	312	312	312

Situation Evaluation:

Environmental stresses may fall under the following categories:

Climate
Social stresses involving group feeding and handling
Production stresses

These stresses may have a marked effect on growth, production, reproduction, and the disease state.

Objectives and/or Research Approaches:

a. Evaluate the interrelationships of various environmental stresses to physiological changes, i.e. hormone secretions.

b. Determine the predisposition of the physiological state to conditions of economic importance, i.e. milk production, reproductive efficiency, growth and disease susceptibility.

Potential Benefits:

With higher per cow production and larger groups of animals in management groups the investigation of environmental stress in relation to animal efficiency has a great possibility for immediate progress.

6. PRODUCTION MANAGEMENT SYSTEMS

	Now	Recommendations if: No increase in Southern Region	Recommendations if: 10% increase in Southern Region
Scientific Man Years	3.2	5.6	7.0
Research Problem Area	313	313	313

Situation Evaluation:

Dairy cattle numbers in the Southern region of the United States have followed the national trend of rapid decline, primarily, through a marked decrease in number of individual herds. Considerable compensation for this decline has been made through increased size of herds that remain in production. Major reasons for these changes in the industry are:

The small return per unit of labor and difficulty of obtaining adequate labor

A major shift of population and industry to the South, resulting in competition for both land and labor

The necessity for large capital investment

High milk sales per cow and per worker are the keys to profitable dairying. This does not exclude small family-size herds of less than 100 cows. However, most dairymen are increasing herd size to make more efficient use of milking facilities and other labor-saving equipment and to utilize the feed potential from good crop land. With these trends the need is urgent for research on complete cow-handling systems that minimize pasture-oriented forage programs and conventional stanchion barn housing and maximize complete dry lot feeding under loose housing systems.

Programs are needed that emphasize the systems idea with major consideration of such problems as group handling of animals from young calves through maturity, waste handling, automated feeding, milking systems, cow treatment facilities, temperature control, and future expansion.

Objectives and/or Research Approaches:

a. Through a multidisciplinary approach develop complete programs for managing dairy cattle to include the most effective design and construction of barns for both young and mature stock, milking parlors, milk handling equipment, waste disposal systems, automated feeding systems, and crop production and storage systems.

b. Identify the importance of specific herd management practices such as calf raising, breeding and selection, individual records, social behavior patterns, group feeding, and temperature control.

c. Identify management practices which will aid in effective heat detection and optimum calving intervals.

d. Develop improved methods of formulating and presenting feeds to groups of dairy cattle.

e. Develop methods that will improve the efficiency of milking systems.

f. Identify the physiological and behavioral responses of cattle to various natural and man-made environmental conditions.

g. Develop crop varieties and cropping systems which will make maximum use of available labor and equipment.

h. Develop dairymen's abilities to handle labor including the man to man relationship as well as the effective use of wage levels and incentives.

i. Develop screening criteria for potential dairy workers so that better placement of workers takes place and turnover of workers goes down.

j. Statistical and computer approaches now make individual farm records and farm analysis possible on a timely basis. Analysis procedures need to be further evolved to fit the dairy enterprise.

Potential Benefits:

Only by understanding the complexities of the interactions of many factors can rapid animal and farm unit efficiency continue.

7. WASTE MANAGEMENT

		Recommendations if:	
	Now	No increase in Southern Region	10% increase in Southern Region
Scientific Man Years	2.4	6.0	6.0
Research Problem Area	901	901	901

Situation Evaluation:

The use of confinement systems for dairy cattle and the emphasis on reducing environmental pollution are forcing the dairy industry to find more effective methods of managing animal waste.

The oldest and most efficient method of waste management known to man is to recycle animal waste to the land without degrading the soil or water. This method of handling waste is not always possible today under the conditions of the narrow ratio of animal number to land area available to many dairies. On the other hand, treatment of animal wastes by conventional sewage treatment plants such as those used by municipalities is not economically feasible for dairy farms.

Present technology on liquid manure systems, both aerobic and anaerobic, facilitates manure storage and provides at least partial treatment of liquid manure waste; however, effluents from these systems seldom meet water quality standards. Discharge of effluents from these systems to the land, streams and waterways must be carefully managed.

Research on aerobic and anaerobic degration of animal waste must be continued to improve the present alternative systems of animal waste management. Another approach to the problem of animal waste management that merits more intensive research is by-product reclamation of dairy cattle waste. Experiments have shown that dairy cattle manure can be utilized as a growth medium for microorganisms and lower animals, such as earthworms and flies. These organisms can be harvested from the degraded waste and may be used as high quality animal feed supplements.

Objectives and/or Research Approaches:

a. Determine the optimum and maximum loading rates of manure on the land as governed by environmental factors of the locality.

b. Develop economical and efficient techniques of enhancing microbial degradation of liquid manure.

c. Determine the nutritional value of dairy cattle manure as animal feed.

d. Establish methods of manure use in the cultivation of microorganisms and lower animals.

e. Develop efficient and economical methods of handling and composting manure for use in cultivation of plants.

Potential Benefits:

Wastes must be properly disposed of and/or treated. With environmental standards continuing to be tightened this becomes a high priority problem.

C. DAIRY PRODUCT DEVELOPMENT AND QUALITY

The outstanding nutritious qualities of milk have been recognized for many years but additional factors have contributed to its widespread use such as (a) desirable and pleasing flavor and (b) convenience and versatility.

Achieving consumer acceptance of dairy products that are highly nutritious is a constant goal. All dairy research should have a direct or indirect concern for the acceptance of the ultimate end-products -- milk and milk products that are consumed and enjoyed by consumers. The impact of changes that have taken place in production, processing and marketing could have a significant influence on the acceptance of dairy products by today's consumers and should be examined thoroughly.

Scientific Man Year recommendations (with no increase in the Southern region) are for no change in this section except for an increase of 0.7 in Waste Management. However, it is felt that there should be considerably more research studies that examine, in depth, the chemical and microbiological bases of these problem areas.

1. PRODUCTION OF MILK FOR IMPROVED CONSUMER ACCEPTANCE

		Recommendations if:	
	Now	No increase in Southern Region	10% increase in Southern Region
Scientific Man Years	11.4	11.4	12.0
Research Problem Area	409(1.0)*	409(1.0)	409(1.6)
	410(8.1)	410(8.1)	410(8.1)
	412(2.3)	412(2.3)	412(2.3)

*Distribution of SMY's by RPA No. is represented in ( ).

Situation Evaluation:

One of the most important areas of dairy research is the area of product quality in relation to consumer acceptance. The quality control procedures that are available to the dairy industry are not adequate to insure that the product will be acceptable when it reaches the consumer. New and more sophisticated techniques are needed that would allow the dairy plant to routinely evaluate the raw milk prior to acceptance, to monitor product quality during processing and storage, and to predict or estimate the shelf-life of the finished products.

Management practices, especially nutrition and major shifts to a higher percentage of Holstein cattle, have influenced production and composition of milk. The influence of these factors on flavor development and the functional properties of milk have received little attention. The fat content of milk produced in the Southern region has dropped from approximately 4.4% to 3.8% during the past two decades. Although the fat decline is generally considered to be desirable, this decrease in fat is accompanied by a decrease in solids non-fat. Increasing the solids non-fat content has been shown to improve consumer acceptance of milk products. Also, milk production and composition is affected by the health of the cow. For example, mastitis has been shown to cause significant changes in the composition of milk which may influence the functional properties of milk and consumer acceptance of the finished products.

A desirable and pleasing flavor is perhaps the most important asset of milk and its products. It is the characteristic that has been a roadblock in the development of imitation dairy products. The first prerequisite to improving the flavor of dairy products offered to the consumer is the development of accurate and objective laboratory procedure for detecting off-flavors.

Objectives and/or Research Approaches:

a. Establish efficient quality control tests for detecting product deterioration and off-flavors.

b. Investigate the influence of farm production and plant processing conditions on the susceptibility of milk to flavor deterioration.

Potential Benefits:

Efficient means of detecting product deterioration and off-flavors can mean a better product for consumers.

2. NEW AND IMPROVED DAIRY PROCESSES AND PRODUCTS

		Recommendations if:	
	Now	No increase in Southern Region	10% increase in Southern Region
Scientific Man Years	3.1	3.1	3.4
Research Problem Area	410	410	410

Situation Evaluation:

Milk is a highly perishable product. Of all the major beverages consumed in the U. S., milk is the only one that is subject to bacteriological spoilage. The deterioration of dairy products is a gradual process and consequently consumer acceptance decreases in a gradual manner. Procedures available to the dairy industry are not adequate for assessing the keeping quality properties of milk products. (See RPA 409) In many cases the products are consumed before laboratory results are available. A rapid and objective procedure for monitoring keeping quality of products during processing and handling would enable the processor to establish more effective processing and sanitation procedures while reducing the problems of products becoming spoiled by the time they reach the consumers. In many cases loss of products because of lack of market stability is a problem and results in a greater cost of products sold.

Objectives and/or Research Approaches:

a. Develop sterile milk products with improved flavor.

b. Obtain additional knowledge regarding the mode of action of various stabilizers and emulsifiers, as well as other food additives, in milk products and their response to processing procedures.
Manufacturers of dairy products, such as ice cream, cottage cheese dressing, yogurt and others, have incorporated various stabilizing and emulsifying agents as a means of improving those products. Most of the research on usage of such products has been done by commercial suppliers and their results have not been published. Consequently, the dairy products processor knows very little about the application of stabilizers or emulsifiers in the manufacture of his products or the reaction of such products to the processing procedures he uses. In addition, the nutritional aspects of these additives should be thoroughly evaluated.

Potential Benefits:

More basic research on the interaction of various additives and food nutrients will make possible the manufacture of new and better quality formulated foods with greater stability in the marketplace and in the home.

3. SYSTEMS OF STORAGE AND HANDLING THAT WILL RETAIN THE ORIGINAL QUALITIES OF PROCESSED MILK PRODUCTS

		Recommendations if:	
	Now	No increase in Southern Region	10% increase Southern Region
Scientific Man Years	1.8	1.8	1.8
Research Problem Area	412	412	412

Situation Evaluation:

Changes in the packaging of dairy products could have an influence on consumer acceptance of dairy products. For example, recent studies have shown that milk packaged in plastic bottles often has an oxidized or sunlight flavor. The impact of this development has not received sufficient attention. This could result in lost customers and a decrease in per capita consumption. Research dealing with factors contributing to the off-flavor development in plastic bottles should be investigated with emphasis on production and processing conditions that would make milk more resistant to this change.

Objectives and/or Research Approaches:

a. Evaluate the effects of light on oxidized flavor of milk packaged in plastic bottles.

b. Systematically evaluate the effects of environmental conditions (transportation and store merchandizing conditions) on quality changes of packaged dairy products.

Potential Benefits:

Prevention of quality deterioration of packaged dairy products can result in more favorable consumer acceptance.

4. GRADES AND STANDARDS OF DAIRY PRODUCTS

		Recommendations if:	
	Now	No increase in Southern Region	10% increase Southern Region
Scientific Man Years	0.4	0.4	0.4
Research Problem Area	501	501	501

Situation Evaluation:

The dairy industry has traditionally standardized fluid milk products on the basis of milk fat content. Research has shown that increasing the solids non-fat content of milk products improves consumer acceptance. However, the standardization of milk on the basis of solids non-fat content is not practiced by industry.

There have been virtually no new dairy products in the past two decades that have gained acceptance in the market place. However, this is an area that continues to offer considerable promise to the dairy industry. One of the problems involved in the development of new dairy products has been legislative restrictions on product composition and another has been the lack of scientific information

regarding the application of food additives. Current regulations permit the use of approved food additives in formulated dairy foods and information concerning the function of these materials would be helpful in the development of desirable formulations and processing conditions.

Objectives and/or Research Approaches:

Work with regulatory agencies and other appropriate organizations and persons to explore the possibility of establishing new grades and standards for dairy products.

Potential Benefits:

Better dairy products could be marketed if certain grades, standards, and composition requirements were altered.

5. WASTE MANAGEMENT

		Recommendations if:	
	Now	No increase in Southern Region	10% increase in Southern Region
Scientific Man Years	1.3	2.0	2.5
Research Problem Area	901	901	901

Situation Evaluation:

Recent developments in regulatory activities sponsored by the Environmental Protection Agency have resulted in renewed interests in reducing dairy plant wastes. In many municipal areas, dairy plants are being required to pay surcharges to discharge plant wastes into the municipal system or to install their own pre-treatment systems. Both approaches are expensive and in many cases plants will be forced to reduce their plant wastes or close down. The problems of dairy plant wastes may be divided into two main areas: (a) Disposal of normal waste waters associated with the processing operation, and (b) disposal of whey. Research is needed in both areas.

Approximately 60,000,000,000 pounds of fluid milk is processed annually. At the present time this uses three pounds of water for each pound of milk processed. This results in approximately 180,000,000,000 pounds of waste water per year. About the lowest B.O.D. level that can be expected from the milk plant is 500 ppm B.O.D. This is equivalent to 90,000,000 pounds of B.O.D. per year. At a surcharge of $0.05 per pound, the cost for the total pounds of B.O.D. would be $4,500,000. Under the present systems for in-plant-pre-treating of waste water, the cost would be at least $0.12 per pound of B.O.D. or $10,000,000 annually. Efficient means of reducing the volume of plant wastes and more economical means of in-plant pre-treating of dairy wastes are imperative.

Cheese whey is the number one problem of dairy plant wastes. In the Southern region, cottage cheese or acid whey is a major area of concern. Cheese whey contains approximately .56 lbs of B.O.D. per pound of solids. Approximately 22 billion pounds of cheese whey are produced annually in the U. S. Of this amount of whey, about 6 billion pounds are produced from cottage cheese manufacturers. A large portion of this acid whey is currently dumped at a cost of $10,080,000 ($0.05 per lb B.O.D.) to $26,192,000 ($0.12 per lb B.O.D.). The proper solution is to save and find new and economical uses for these nutrients. If these nutrients were converted to animal feed at $0.04 per lb, they would be valued at $14,000,000 plus the savings from the sewer surcharge. However, the cost of converting to animal feed is near the $0.04 per lb selling price.

Objectives and/or Research Approaches:

a. Explore possibilities for reducing the cost of recovering nutrients from acid whey.

b. Explore the economic possibilities involved in waste nutrient recovery (cost of recovery and waste disposal charges).

Potential Benefits:

Valuable feed ingredients can be salvaged and at the same time a pollution and waste disposal problem can be reduced.

D. EFFICIENCY OF MARKETING MILK AND DAIRY PRODUCTS

Rapid changes in the dairy industry have taken place. These changes have been made possible by many advances in dairy production and processing but have also been influenced by advances being made in our total society. Changes made in these areas have necessitated changes in marketing. The effects of these changes are felt by dairymen, processors and consumers.

With both milk production and the processing and marketing of milk and milk products becoming increasingly specialized and organized, it becomes more important to recognize that all levels are dependent on one another. Therefore, the research emphasis needs to be couched in terms of the total industry or total system from production through sale of the final product, rather than segments.

Factors influencing the demand for milk and milk products need continued study. The pricing mechanism for milk at the farm level in terms of the price level, component pricing and the amount of control needs research emphasis. Efficiency of production systems, production location, and size of units has become particularly important in light of the increased emphasis on the environmental and economic conditions in the South.

Although the SMY recommendations (with no Southern region increase) are for continuation at the current level, it is felt that many more of the management research problems need to involve economists, thus giving a greater interdisciplinary effort to solving these problems.

1. DAIRY PRODUCTION ECONOMICS

		Recommendations if:	
	Now	No increase in Southern Region	10% increase in Southern Region
Scientific Man Years	2.8	2.8	4.0
Research Problem Area	313	313	313

Situation Evaluation:

The impact of change has been dramatic on dairy farmers. As dairy production units increase in size it is difficult to identify the most efficient size in terms of labor requirements, capital requirements and accummulation, and environment effort of concentrated production units. With a few large milk processing plants scattered throughout the nation, studies should be made with regard to the value of preserving the local autonomy of milk production versus location of production in areas with the greatest comparative advantage. This involves a study of the nature of producer organization in the form of cooperatives necessary to provide the services necessary for an adequate supply of milk. Also, the concept of the role of supply management as it affects production decisions needs further clarification, identification, and appraisal.

Objectives and/or Research Approaches:

Areas of investigation in farm economics that are especially relevant in the Southern region:

a. Studies are needed relative to the economics of scale in the dairy enterprise. The trend has been toward very large production units in some Southern supply areas. And, throughout the South the average-size production unit is substantially larger than in the major production regions. Economies and diseconomies of the larger units need to be ascertained.

b. Continued economic analyses of alternative feeding systems and rations on production efficiency are needed. Growth in size of production units necessitate studies of feeding and handling practices, as well as economies of various types of feeds used in new management systems.

c. Increased capital inputs and automation on the farm require greater skills on the part of farm labor. Studies are needed relative to capital investment, substitution of capital for labor, labor quality, supply and management.

d. Analyze various forms of ownership control of production units such as private, partnerships, corporations, cooperatives and leasing arrangements.

e. Analyze methods of financing productive units in terms of sources of credit, arrangements, costs, and length of time of credit needs.

f. Evaluate maximum size of concentrated production units in terms of restrictions related to environmental control, including waste materials, handling, herd health, and labor efficiency.

g. Determine comparative advantage of milk production by areas, as well as alternative enterprise combinations within the region. Determine least cost (per hundredweight of milk) size of unit in terms of labor, housing, financing.

h. Improve production efficiency and net incomes of producers by developing dairy farm records as a management-planning aid, by expanding the scope of production records to include physical quantities and dollar costs of production units for the whole farm as well as the dairy enterprise, and developing procedures for using dairy production and feed reports as a basis for determining the most profitable composition and amount of grain to feed.

i. Assist producers, their suppliers, dairy marketing firms and organizations in planning their operations by comprehensive appraisals of significant changes in the dairy industry. Such changes include the competitive position of various major producing regions, number and size of dairy herds, technological changes in dairy production and marketing, and investment requirements and net returns in dairy production.

Potential Benefits:

A number of possibilities exist for realizing greater economies in the production of milk. These lower production costs can benefit both the producer and the consumer.

2. MARKETING

		Recommendations if:	
	Now	No increase in Southern Region	10% increase in Southern Region
Scientific Man Years	6.2	6.2	7.0
Research Problem Areas	503(3.0)	503(3.0)	503(3.4)
	506(1.8)	506(1.8)	506(1.8)
	507(0.4)	507(0.4)	507(0.4)
	508(1.0)	508(1.0)	508(1.4)

Situation Evaluation:

A number of factors, basically technological, but having significant economic effects, have brought about drastic changes in the dairy marketing in the South and across the nation. These changes have broad impact on operational and pricing efficiencies and must be reckoned with by dairy researchers. Market areas have been widened, producer and milk product prices have become more interrelated among markets and regions, sales have largely shifted from home delivery to grocery stores, distribution methods and practices have adjusted with new demands and technologies, and scale of operating in milk plants has shifted to large volumes. Horizontal and vertical integration has occurred, especially in processing and distribution of milk products. Producer organizations have consolidated and merged across the region. By 1972, most milk in the region was cooperatively marketed, while two decades ago little milk was sold through producer associations. Pricing systems and types of market regulations have changed. Less milk is marketed under state milk orders and more under Federal market orders within the region.

Dairy marketing research has led to accomplishments such as improving methods of determining protein in milk as an alternative basis of paying producers, improved methods of protecting milk products in storage; improved pricing methods; growth of understanding of the nature and effects of broadened distribution areas and adjustments needed in facilities and pricing practices under the impact of bulk milk handling.

Objectives and/or Research Approaches:

The current level of marketing research needs to be continued on improved methods of merchandising dairy products, effects of government and other regulatory programs on the marketing system, and keeping the flow of information to all members of the industry abreast of changes in milk marketing. Areas of marketing research that need emphasis include:

a. Appraising the structure of dairy markets within the region from the standpoint of its impact on pricing and distribution, by analyzing changes in types, sizes, competitive practices, and other characteristics of marketing firms under the influence of progress in technology and other forces, to enable farmers to market their milk more effectively, and to guide governmental programs affecting milk and dairy products.

b. Problems of competition within the region and among regions affecting patterns of milk utilization, location of processing facilities, regional and local structures of cooperatives, milk markets and milk marketing orders, equity of pricing within the region and among regions, and the implications of changes in technology and transportation costs, to increase marketing efficiency and raise returns to producers.

c. In some localities within the region available supplies of Grade A milk have frequently been inadequate for market needs while in other areas excess supplies exist. Problems exist in regard to sharing surpluses, establishing equitable market shares among producers and producer groups, balancing supplies to meet demand by season and by day or week and sharing costs of handling excess supplies. Research is needed to assess the impact of alternative price structures and pooling arrangements on production, market reserves, consumption and producer incomes.

d. Improving methods of determining and maintaining quality of milk and dairy products at all stages of marketing and evaluating preferences and requirements of consumers, industrial users and others by chemical, physical and bacteriological investigations and economic surveys to reduce losses, improve the precision with which the differing needs of users are met, and increase the market value of milk and dairy products.

e. Improving facilities, methods and equipment for handling, marketing, processing, storing and distributing dairy products; measuring and evaluating factors causing changes in margins to bring about increased efficiency and provide better services in marketing.

f. Improved management of marketing firms, including studies of problems in extending farmer control of the marketing of milk and dairy products through cooperative action as a means of enhancing farmers' income from the sale of dairy products.

g. Improving methods for sanitation, insect control to minimize pesticides residues and assure consumers of receiving a safe, healthy and wholesome supply of fresh and processed dairy products.

h. Developing improved transport methods, equipment and techniques for handling, assembling, marketing and distributing dairy products; and evaluating the impact of changes in transportation that might affect production, marketing, processing, storage and distribution to assure consumers of a continuous supply of fresh and processed products that will provide maximum returns to producers.

i. Determining and analyzing basic changes in supply, demand, and prices of dairy products with attention to relationships with competing foods, geographic, demographic, cultural and personal factors, supply, demand and price interactions, and price-making features of the marketing system, to increase the efficiency with which prices respond to market forces and thereby increase returns to producers. Updating of demand relationships is a continuous need. Reliable information is needed concerning the nature of the demand function for milk and milk products, especially regarding price elasticities for the various products and cross elasticities.

Potential Benefits:

Considerable economic and product quality benefits can be brought about through continued research of marketing methods.

SCIENTIFIC-MAN-YEAR AND EXPENDITURE SUMMARY
BY RESEARCH PROBLEM AREA -- USA*

RPA	USDA APPROPRIATIONS	OTHER FEDERAL FUNDS	NON-FEDERAL FUNDS	TOTAL FUNDS	SMY'S
210	$ 794,587	$ 69,310	$ 157,220	$ 1,021,117	16.5
211	3,938,121	407,149	1,525,670	5,870,940	62.1
212	677,073	50,608	176,563	904,245	12.0
213	626,115	76,500	136,546	839,162	8.4
214	9,133	12	19,859	29,004	.6
310	768,242	361,654	1,867,212	2,997,108	42.7
311	3,741,898	561,339	7,138,412	11,441,649	140.9
312	279,340	3,598	499,046	781,984	12.0
313	148,232	17,501	1,027,936	1,193,669	14.1
317	91,633	0	197,401	289,033	3.5
409	202,469	7,747	266,572	476,789	8.6
410	1,936,972	190,390	1,267,382	3,394,744	70.9
411	20,365	0	3,062	23,427	.7
412	361,039	12,649	287,420	661,108	10.5
501	15,092	0	19,603	34,695	.5
503	450,092	18,661	178,774	647,526	14.2
506	208,973	16,763	100,680	326,416	6.5
507	59,139	3,217	101,173	163,529	2.8
508	74,091	1,000	31,893	106,983	2.3
509	176,529	2,645	27,857	207,031	6.0
601	17,460	0	0	17,460	.2
701	629,948	17,852	189,044	836,843	10.6
702	234,361	48,708	126,769	409,838	6.6
703	1,678	0	2,755	4,433	.1
704	0	0	26,302	26,302	.1
708	697,773	2,769	19,653	720,195	15.0
807	42,625	7,521	0	50,146	1.1
808	19,622	3,457	3,824	26,903	.9
901	1,759,597	35,107	189,648	1,984,352	34.4
TOTAL	$17,982,198	$ 1,916,156	$15,588,275	$35,486,629	505.0

*Data supplied by Dr. C. R. Richards from Current Research Information System for the 1972 calendar year. The data include Agricultural Experiment Station and USDA Laboratory Expenditures and SMY's.

SCIENTIFIC-MAN-YEAR AND EXPENDITURE SUMMARY
BY RESEARCH PROBLEM AREA -- SOUTHERN REGION*

RPA	USDA APPROPRIATIONS	OTHER FEDERAL FUNDS	NON-FEDERAL FUNDS	TOTAL FUNDS	SMY'S
210	$ 593,657	$ 56,472	$ 59,520	$ 709,649	11.0
211	80,390	579	429,861	510,830	7.8
212	196,159	13,735	106,734	316,627	5.8
213	295,449	0	5,211	300,660	2.8
214	3,770	0	0	3,770	.1
310	175,150	16,319	725,079	916,548	12.1
311	874,235	37,612	2,250,147	3,161,994	43.5
312	116,761	0	93,953	210,715	3.2
313	37,848	481	430,620	468,949	5.4
317	260	0	574	834	.0
409	48,336	0	58,622	106,958	1.9
410	220,701	8,393	279,246	508,340	11.6
411	20,365	0	3,062	23,427	.7
412	160,037	0	98,745	258,782	3.5
501	12,933	0	18,978	31,911	.4
503	75,782	0	15,047	90,830	2.8
506	27,306	100	16,642	44,049	1.6
507	14,733	0	738	15,471	.3
508	13,859	0	14,000	27,859	.9
509	18,507	0	5,741	24,248	.9
701	248,027	0	21,758	269,785	3.2
702	21,275	0	60,101	81,375	1.3
704	0	0	840	840	.1
708	7,757	0	5,225	12,981	.5
808	5,522	0	208	5,729	.3
901	42,035	0	52,787	94,821	2.4
TOTAL	$ 3,310,853	$ 133,691	$ 4,753,436	$ 8,197,980	124.0

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